

2002 QAPP for the Upper Ashuelot River TMDL Study

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1.0 Title and Approval Page

Document Title: Quality Assurance Project Plan for the Upper
Ashuelot River TMDL Study

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Services (NHDES)

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Signature / Date

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2.2 Document Control Format

The document control format is shown in the upper right hand corner of each page of this document.

2.3 Document Control Numbering System

A document control numbering system for all copies of this QAPP was not used because this project is of a small scale. The people who will receive copies of the QAPP are listed in Table 1 in Section 3.0.

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2.4 EPA-NE QAPP Worksheet #2

See Table 1 below.

Table 1: EPA-NE QAPP Worksheet #2

1. Identify Guidance used to prepare QAPP:

Format and content: Region I, EPA-NE Compendium of QAPP Requirements and Guidance, Final October 1999, and Attachment A, Region I, EPA-NE QAPP Manual. Draft, September, 1998.

Scale of content: EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5. Interim final, November, 1999.

2. Identify EPA Program: Clean Water Act Section 106, TMDL Program

3. Identify approval entity: EPA-NE, State, or other: EPA-New England

4. Indicate whether the QAPP is a generic program QAPP or a project specific QAPP. (underline one)

5. List dates of scoping meetings that were held: 6/27/01

6. List title of QAPP documents and approval dates written for previous site work, if applicable:

Title

Approval Date

N/A

7. List organizational partners (stakeholders) and connection with EPA and/or State:

NH Department of Environmental Services, Water Division, Watershed Management Bureau

City of Keene and Town of Swanzey

USEPA Region I

Ashuelot River Volunteer Monitoring Organization

8. List data users:

NH Department of Environmental Services

USEPA Region I

9. If any required QAPP Elements (1-20), Worksheets and/or Required Information are not applicable the project, then circle the omitted QAPP Elements, Worksheets and Required Information on the attached Table. Provide an explanation for their exclusion below:

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Table 2: List of Required EPA Elements and Worksheets

Required EPA QA/R-5 QAPP Elements	Required EPA-NE QAPP Elements and Corresponding EPA-NE QAPP Sections	EPA-NE QAPP Worksheet #	Required Information
Project Management and Objectives			
A1	1.0 Title and Approval Page	1	-Title and Approval Page
A2	2.0 Table of Contents and Document Format 2.1 Table of Contents 2.2 Document Control Format 2.3 Document Control Numbering System 2.4 EPA-NE QAPP Worksheet #2	2	-Table of Contents -EPA-NE QAPP Worksheet
A3	3.0 Distribution List and Project Personnel Sign-off Sheet	3 4	-Distribution List -Project Personnel Sign-off Sheet
A4, A8	4.0 Project Organization 4.1 Project Organizational Chart 4.2 Communication Pathways 4.2.1 Modifications to Approved QAPP 4.3 Personnel Responsibilities and Qualifications 4.4 Special Training Requirements/ Certification	5a 5b 6 7	-Organizational Chart -Communication Pathways -Personnel Responsibilities and Qualifications Table -Special Personnel Training Requirements Table
A5	5.0 Project Planning/Project Definition 5.1 Project Planning Meetings 5.2 Problem Definition/Site History and Background	8a 8b	-Project Scoping Meeting Attendance Sheet with Agenda and other Project Planning Meeting Documentation -Problem Definition/Site History and Background -EPA-NE DQO Summary Form -Site Maps (historical and present)
A6	6.0 Project Description and Schedule 6.1 Project Overview 6.2 Project Schedule	9a 9b 9c 9d 10	-Project Description -Contaminants of Concern and Other Target Analytes Table -Field and Quality Control Sample Summary Table -Analytical Services Table -System Designs -Project Schedule Timeline Table
A7	7.0 Project Quality Objectives and Measurement Performance Criteria 7.1 Project Quality Objectives 7.2 Measurement Performance Criteria	11a 11b	-Project Quality Objectives/Decision Statements -Measurement Performance Criteria Table

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Required EPA QA/R-5 QAPP Elements	Required EPA-NE QAPP Elements and Corresponding EPA-NE QAPP Sections	EPA-NE QAPP Worksheet #	Required Information
Measurement/Data Acquisition			
B1	8.0 Sampling Process Design 8.1 Sampling Design Rationale	12a 12b	-Sampling Design and Rationale -Sampling Locations, Sampling and Analysis Method/SOP Requirements Table -Sample Location Map
B2, B6, B7, B8	9.0 Sampling Procedures and Requirements 9.1 Sampling Procedures 9.2 Sampling SOP Modifications 9.3 Cleaning and Decontamination of Equipment/Sample Containers 9.4 Field Equipment Calibration 9.5 Field Equipment Maintenance, Testing and Inspection Requirements 9.6 Inspection and Acceptance Requirements for Supplies/Sample Containers	13 12b 14 15	-Sampling SOPs -Project Sampling SOP Reference Table -Sampling Container, Volumes and Preservation Table -Field Sampling Equipment Calibration Table -Cleaning and Decontamination SOPs -Field Equipment Maintenance, Testing and Inspection Table
B3	10.0 Sample Handling, Tracking and Custody Requirements 10.1 Sample Collection Documentation 10.1.1 Field Notes 10.1.2 Field Documentation Management System 10.2 Sample Handling and Tracking System 10.3 Sample Custody	16	-Sample Handling, Tracking and Custody SOPs -Sample Handling Flow Diagram -Sample Container Label (Sample Tag) -Chain-of-Custody Form and Seal
B4, B6, B7, B8	11.0 Field Analytical Method Requirements 11.1 Field Analytical Methods and SOPs 11.2 Field Analytical Method/SOP Modifications 11.3 Field Analytical Instrument Calibration 11.4 Field Analytical Instrument/Equipment Maintenance, Testing and Inspection Requirements 11.5 Field Analytical Inspection and Acceptance Requirements for Supplies	17 18 19	-Field Analytical Methods/SOPs -Field Analytical Method/SOP Reference Table -Field Analytical Instrument Calibration Table -Field Analytical Instrument/Equipment Maintenance, Testing and Inspection Table

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Required EPA QA/R-5 QAPP Elements	Required EPA-NE QAPP Elements and Corresponding EPA-NE QAPP Sections	EPA-NE QAPP Worksheet #	Required Information
B4, B6, B7, B8	12.0 Fixed Laboratory Analytical Method Requirements 12.1 Fixed Laboratory Analytical Methods and SOPs 12.2 Fixed Laboratory Analytical Method/SOP Modifications 12.3 Fixed Laboratory Instrument Calibration 12.4 Fixed Laboratory Instrument/ Equipment Maintenance, Testing and Inspection Requirements 12.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies	20 21	-Fixed Laboratory Analytical Methods/SOPs -Fixed Laboratory Analytical Method/SOP Reference Table -Fixed Laboratory Instrument Maintenance and Calibration Table
B5	13.0 Quality Control Requirements 13.1 Sampling Quality Control 13.2 Analytical Quality Control 13.2.1 Field Analytical QC 13.2.2 Fixed Laboratory QC	22a 22b 23a 23b 24a 24b	Sampling - Field Sampling QC Table - Field Sampling QC Table cont. Analytical - Field Analytical QC Table - Field Analytical QC Table cont. - Field Screening/Confirmatory Analysis Decision Tree - Fixed Laboratory Analytical QC Sample Table - Fixed Laboratory Analytical QC Sample Table cont.
B9	14.0 Data Acquisition Requirements	25	-Non-Direct Measurements Criteria and Limitations Table
A9, B10	15.0 Documentation, Records and Data Management 15.1 Project Documentation and Records 15.2 Field Analysis Data Package Deliverables 15.3 Fixed Laboratory Data Package Deliverables 15.4 Data Reporting Formats 15.5 Data Handling and Management 15.6 Data Tracking and Control	26	-Project Documentation and Records Table -Data Management SOPs

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Required EPA QA/R-5 QAPP Elements	Required EPA-NE QAPP Elements and Corresponding EPA-NE QAPP Sections	EPA-NE QAPP Worksheet #	Required Information
Assessment/Oversight			
C1	16.0 Assessments and Response Actions 16.1 Planned Assessments 16.2 Assessment Findings and Corrective Action Responses 16.3 Additional QAPP Non-Conformances	27a 27b 27c	-Assessment and Response Actions -Project Assessment Table -Project Assessment Plan -Audit Checklists
C2	17.0 QA Management Reports	28	-QA Management Reports Table
Data Validation and Usability			
D1	18.0 Verification and Validation Requirements		-Validation Criteria Documents
D2	19.0 Verification and Validation Procedures	29a 29b 29c	-Data Evaluation Process -Data Validation Summary Table -Data Validation Modifications
D3	20.0 Data Usability/Reconciliation with Project Quality Objectives	30	-Data Usability Assessment

3.0 Distribution List and Project Personnel Sign-off Sheet

Table 3 presents a list of people who will receive the approved QAPP, the QAPP revisions, and any amendments. See Section 1.0 for the Project Personnel Sign-Off Sheet.

Table 3: QAPP Distribution List (based on EPA Worksheet #3)

QAPP Recipient Name	Title	Organization	Telephone Number
Alison Simcox	USEPA Project Officer	USEPA, New England	617-918-1684
Charles Porfert	USEPA Quality Assurance Officer	USEPA New England	617-918-8313
Gregg Comstock	Project Manager	NHDES, Water Division, Watershed Management Bureau	603-271-2983
Peg Foss	TMDL Coordinator	NHDES, Water Division, Watershed Management Bureau	603-271-5448
Paul Piszczek	Field Coordinator	NHDES, Water Division, Watershed Management Bureau	603-271-2471
Steve Couture	Project QA Officer	NHDES, Water Division, Watershed Management Bureau	603-271-8801
Rachel Rainey	NHDES Laboratory QA Officer	NH DES Laboratory	603-271-2993

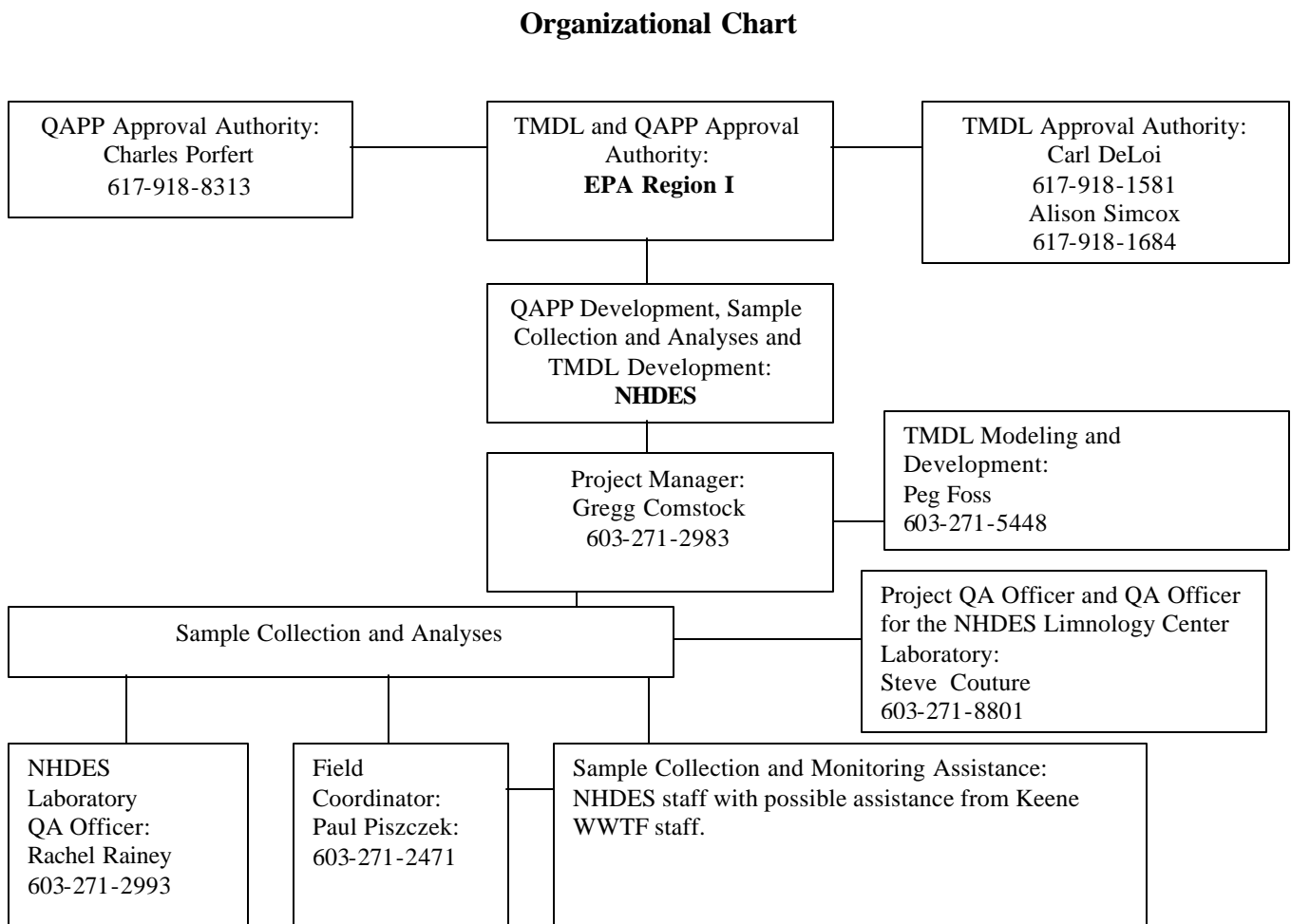
4.0 Project Organization

This section identifies the organizations and key personnel participating in the project and describes their specific roles, responsibilities and qualifications. This section also explains communication pathways.

4.1 Project Organization Description and Chart

Figure 1 shows an organizational chart for this project. A description of each person's responsibilities, is provided in Section 4.3.

Figure 1. Organizational Chart for Ashuelot River TMDL



4.2 Communication Pathways

The Project Manager will be the primary contact for all parties involved in this study. If problems arise in the field, laboratory, or in any phase of the study, the Project Manager will be contacted and will determine the best course of action.

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4.2.1 Modifications to Approved QAPP

If the sampling design or sample collection procedures needs to be modified, the Project Manager will submit the modifications to EPA Region I.

If the sample analysis procedures need to be modified, the Lab Manager will work with the Project Manager and then the Project Manager will submit the modifications to EPA Region I.

If data assessment and reporting needs to be modified, the Project Manager will submit the modifications to EPA Region I.

4.3 Personnel Responsibilities and Qualifications

Table 4 identifies personnel responsibilities for this project.

Table 4. Personnel Responsibilities and Qualifications (based on EPA Worksheet #6)

Name and Affiliation	Responsibilities	Education and Experience Qualifications
Carl Deloi EPA Region I	Responsible for issuing final approval of TMDL	On file at EPA
Alison Simcox EPA Region I	Responsible for reviewing TMDL for completeness	On file at EPA
Charlie Porfert EPA Region I Laboratory	Responsible for review and approval of QAPP	On file at EPA
Gregg Comstock NHDES	Project Manager in overall charge of all work associated with TMDL development including QAPP preparation and any revisions to the QAPP.	On file at NHDES
Steve Couture NHDES	Project QA Officer: Reviews QAPP preparation and other QA/QC activities. QA/QC Officer for the NHDES Limnology Center.	On file at NHDES
Paul Piszczek NHDES	Field Coordinator: Assists Project Manager with organizing and coordinating all field activities.	On file at NHDES
Rachel Rainey NH DES Laboratory Services	Oversees laboratory QA/QC activities and identifies necessary corrective actions.	On files at NHDES
Jack Parr EPA Region I Laboratory	Responsible for collection and analysis of sediment oxygen demand samples.	On file at EPA
Peg Foss TMDL Coordinator NHDES	Responsible for modeling, preparation and presentation of TMDL.	On file at NHDES

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4.4 Special Training Requirements/Certification

Table 5 displays the information for project activities that require some level of training.

Table 5. Special Personnel Training Requirements (based on EPA Worksheet #7)

Project function	Description of Training	Training Provided by	Training Provided to	Location of Training Records
Field analyses (DO, pH, conductivity, temperature)	Water sample collection procedures	Training to be provided by Paul Piszczek and/or Beth Malcolm	All personnel who will be leading sampling teams.	Documentation will be on file at NHDES
Hydrolabs for continuous DO, pH, conductivity and temperature measurements.	Proper calibration, installation and use of hydrolabs	Training to be provided by Paul Piszczek	All personnel who will be leading teams to install hydrolabs.	Documentation will be on file at NHDES
Flow measurements	Proper calibration and use of velocity meters and methods for measuring flow in streams.	Training to be provided by Paul Piszczek	All personnel who will be leading streamflow measurement teams.	Documentation will be on file at NHDES
Sample collection for laboratory analyses	Proper techniques for sample collection and preservation	Training to be provided by Paul Piszczek and/or Beth Malcolm	All personnel who will be leading sampling teams.	Documentation will be on file at NHDES
Automatic samplers for collecting composite samples from WWTFs	Proper use of automatic samplers for collecting composite samples from WWTFs	Training to be provided by Kendall Perkins or Stephanie Larson	All personnel who will be leading teams to sample WWTF effluent.	Documentation will be on file at NHDES

5.0 Project Planning/Project Definition

This section documents the project planning, identifies the environmental problem, defines the environmental questions that need to be answered and provides background information.

5.1 Project Planning Meetings

On June 27, 2001 a meeting was held at the Keene WWTF to discuss this project. The following people attended: Donna Hanscom of the Keene WWTF; Tom Hastings, Operator for the West Swanzey WWTF; Barbara Skuly of the Ashuelot River Volunteer Monitoring Organization and Paul Currier, Gregg Comstock and Paul Piszczek of NHDES. Proposed sampling locations were discussed. Ms. Hanscom offered the assistance of her staff to help sample and the use of three hydrolabs which they just purchased. Identifying the cause of apparent low dissolved oxygen levels upstream of the Keene WWTF is a primary concern of Ms. Hanscom's. Following this meeting, Mr. Currier, Mr. Comstock and Mr. Piszczek visited each proposed sampling site. On July 17, 2001, personnel from NHDES, who will be assisting with sampling (10 people), visited each sampling site.

6.0 Project Description and Schedule

This section presents a general overview of the activities that will be performed during this project and a schedule for implementation.

6.1 Project Overview

The Ashuelot River begins in Goshen and flows approximately 40 miles where it joins the Connecticut River near the Massachusetts border. The river drains approximately 420 square miles and has several dams. The Keene and West Swanzey WWTFs discharge to the upper portion of the Ashuelot River. In 1989, a Wasteload Allocation (WLA) Study was completed from Keene to just downstream of West Swanzey which concluded the following.

1. During the study, no violations of dissolved oxygen were measured downstream of the Keene WWTF.
2. Dissolved oxygen violations were, however, recorded upstream of the Keene WWTF.
3. At 7Q10 low flow conditions and assuming the Keene WWTF is discharging at full secondary permit conditions, computer modeling results predict that the Keene WWTF will violate dissolved oxygen standards and that advanced treatment is necessary.

The 1989 WLA Study recommended that a study be conducted to determine the sources of low dissolved oxygen levels upstream of the Keene WWTF and to make recommendations to eliminate or reduce them. The WLA Study also recommended that a study be done to determine the impact of algae on dissolved oxygen levels in the Homestead Woolen Dam impoundment in West Swanzey. To answer these questions and to determine appropriate effluent limits for the two WWTFs and any required reduction in nonpoint-source loadings, a Total Maximum Daily Load (TMDL) study will be conducted for the upper portion of the Ashuelot River.

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To facilitate development of the TMDL, sampling is necessary to assess concentrations and loads of selected pollutants such as carbonaceous oxygen demand (CBOD), ammonia and/or phosphorus, that may impact dissolved oxygen concentrations in the Ashuelot River. Data generated during this study will be used to develop a QUAL2E water-quality model, which will be used to develop both point-source and nonpoint-source Total Maximum Daily Loads for pollutants impacting dissolved oxygen levels in the Ashuelot River. Information from this study will be used to establish appropriate discharge permit limits for the Keene and West Swanzey WWTFs.

The focus area for this study begins just below the Surry Mountain Dam in Surry, and extends downstream along the Ashuelot River through the City of Keene and the Town of Swanzey and partly into the Town of Winchester. In all, approximately 19 miles of the Ashuelot River will be sampled. A site map showing the location of sampling stations is included in Appendix A.

Sampling tasks: In general, samples will be collected and analyzed for total suspended solids (TSS), 5 and/or 20 day Biochemical oxygen demand (BOD5 and BOD20), ammonia nitrogen (NH₃-N), nitrite and nitrate nitrogen (NO₂-NO₃-N), total phosphorus (TP), dissolved orthophosphorus (PO₄-P), total organic carbon (TOC), chlorophyll a (chlor a) and sediment oxygen demand (SOD – in 2002). Field measurements will include dissolved oxygen, temperature, pH, specific conductivity and flow. These parameters (with the exception of pH and conductivity) are needed to develop the QUAL2E water quality model for dissolved oxygen.

Weather permitting, the sampling program will consist of a minimum of two, and up to three sampling events. Field measurements and samples will be collected from the two WWTFs, at selected sites along the Ashuelot River and near the confluence of major tributaries as shown on the sampling plan in Appendix A. An additional sampling event will be scheduled in the summer of 2002 to obtain sediment oxygen demand samples from selected sites. It is anticipated that SOD samples will be collected and analyzed in the summer of 2002 by the EPA Region I Laboratory. An addendum to the QAPP will be prepared for the SOD portion of the plan and submitted at a later date. The addendum will include specific details and supporting information for the SOD study.

More detailed information regarding the sampling program is provided in Sections 8 and 9.

Analysis tasks: Standard Operating Protocols (SOPs) for the field and laboratory are provided in Appendices B and C respectively. Table 6 and Table 8 summarize information relevant to analytical services and field measurements.

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Table 6: Surface water analytical services table (based on EPA Worksheet #9d)

Analyte	Laboratory contact or instrument and person responsible
LAB ANALYSIS	
TSS TOC TP Dissolved PO4-P TKN NH3-N NO2&NO3-N BOD (5 and 20 day) Chlorophyll a	NH DES Chemistry Laboratory 6 Hazen Drive, Concord NH 03304 Rachel Rainey, 603-271-2993 NHDES Limnology Center (for Chlorophyll-a) 6 Hazen Drive, Concord NH 03304 Steve Couture, 603-271-8801
Sediment Oxygen Demand	EPA Region I Laboratory Chelmsford, MA Jack Parr, 617-918-8604
FIELD ANALYSIS	
Temperature Dissolved oxygen pH Specific Conductivity	Person responsible for training: Field Coordinator. YSI 95-25 Meter YSI 95-25 Meter Orion 210A Meter YSI 30M Meter
Continuous automatic recording meter for Temperature, Dissolved Oxygen, pH, and Specific Conductivity	Person responsible for training: Field Coordinator Hydrolab Datasonde 4/Minisonde Multiprobe Datalogger
Stream flow	Person responsible for training: Field Coordinator Name of Instrument: Marsh-McBirney Model 2000 Flow-Mate Velocity Meter

Quality control tasks: . A complete description of quality control tasks is included in Section 13.0.

Secondary data: Not applicable.

Data management tasks: : Field data will be recorded on a field sheet and entered into a computer spreadsheet (MS Excel). Laboratory data will be entered into a bench book and then entered into a spreadsheet program (such as MS Excel, Lotus, Sigma Plot, and FoxPro) for analysis and tracking. Data printouts will be cross-referenced with bench book results for verification/validation purposes.

Documentation and records: Field sampling sheets with checklists will be used throughout the study to ensure an all inclusive sample activity. Hardcopy and computer records will be kept for each parameter. A complete description of documentation and records are included in Section 15.0.

Data packages: N/A

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Assessment/Audit tasks: Assessments and audits are components of the NHDES Quality Assurance/Quality Control Plan. Table 29 identifies the person(s) responsible for implementing and monitoring any required corrective action for laboratory and field sampling. Table 9, Table 10 and Table 11 describe both field and laboratory measurement performance criteria including data quality indicators such as duplicate measurements and spiked samples (laboratory). A replicate is run for every ten samples in the laboratory, and the data are presented in a QA/QC report at the end of each year. Also, for every sampling round collected, ten percent field sampling duplicates are collected. All field equipment maintenance, testing and inspection requirements are detailed in Table 16. A detailed narrative description of planned assessments, assessment findings and corrective action responses for field sampling and analytical work can be found in Section 16.1 and 16.2.

Data verification and validation tasks: Data verification will include examining QA data by means of replicate and critical range checks, internal consistency checks of spiked samples and duplicate samples. Questionable data will be highlighted and examined to determine the origin of the deviation. The validation involves assessing the reasonableness of the data based on the measured and the expected values for that parameter. A complete description of data verification and validation tasks and procedures are included in Sections 18.0 and 19.0.

Data usability tasks: Data usability will be based on data verification and validation. Section 20.0 includes a complete description of data usability assessments.

6.2 Project Schedule

Table 7 presents a proposed schedule of the work to be performed for this project. The schedule is very much dependent on the weather. All samples collected in 2001 were collected during critical low flow conditions as described in Table 10, Note #2. 2002 data will also be collected only during critical low flow conditions. Should critical low flow conditions not occur in the summer of 2002, sampling may have to be postponed until the following summer. The Project Manager will notify all those affected by the delay, including EPA.

Table 7. Project Schedule Timeline (based on EPA Worksheet #10)

Activity	Dates (MM/DD/YYYY)		Deliverable	Deliverable Due Date
	Anticipated Date(s) of Initiation	Anticipated Date(s) of Completion		
QAPP Preparation	06/15/2001	07/19/2001	QAPP Document	07/23/2001
2001 Sample collection (excluding SOD)	07/31/2001	09/15/2001	Samples collected	09/15/2001
2002 Sample collection (excluding SOD)	08/05/2002	09/15/2002	Samples Collected	09/15/2002
2001 Laboratory Analyses and Results Received (excluding SOD)	8/1/2001	11/30/2001	Laboratory Results	12/15/2001
2002 Laboratory Analysis and Results Received (excluding SOD)	08/12/2002	11/30/2002	Laboratory Results	12/15/2002
Data validation (excluding SOD)	11/30/2001 11/30/2002	12/31/2001 12/31/2002	N/A	
SOD collection and analysis	10/28/2002	11/01/2002	SOD samples collected and analyzed	Refer to EPA Addendum
SOD results received			SOD results	Refer to EPA Addendum
Draft TMDL report prepared	9/1/2001	5/1/2003	Draft TMDL Report	5/1/2003

7.0 Project Quality Objectives and Measurement Performance Criteria

This section documents the environmental decisions that need to be made and the level of data quality needed to ensure that the decisions are based on sound data.

7.1 Project Quality Objectives

NHDES will use the data to prepare a TMDL report for dissolved oxygen on the Ashuelot River. The data will also be available for other interested parties such as the City of Keene, the Town of Swanzey, EPA, volunteer monitoring organizations and others.

Data needs to be representative of the conditions in the river to develop a defensible computer model and to support the conclusions of the TMDL study. Therefore it is necessary that data be collected on a consistent basis and in accordance with protocols described herein. The proposed sampling design will yield sufficient data for this purpose. Precision, accuracy/bias, quantitation limits and completeness of data are addressed in Section 7.2 below.

Data will be analyzed by DES with means and ranges calculated for each parameter at each station. The TMDL report will include a summary of the data collected for this study, results of computer modeling, the total allowable loading of pollutants for point and nonpoint sources that will meet dissolved oxygen water quality standards and recommendations for meeting these loads.

7.2 Measurement Performance Criteria

Table 8 shows the overall precision, lab precision, accuracy/bias, comparability, sensitivity and data completeness for this project. Definitions of each are provided below.

Precision is the degree of agreement among repeated measurements of the same characteristic (parameter) under the same or similar conditions. Precision will be measured by analyzing sample replicates and determining if those replicates fall within the critical range for that testing protocol. If the replicate falls within the critical range, the precision will be acceptable. If the replicate falls outside of the critical range, the sample will be run again to determine if there was an error in the analyzer or the equipment that led to the imprecision.

Where there is one duplicate for a sample, duplicate precision will be analyzed using the following equation;

$$RPD (\%) = \frac{|x_1 - x_2|}{(x_1 + x_2)/2} \times 100$$

where x_1 is the original sample concentration
 x_2 is the replicate sample concentration

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Accuracy and bias are interchangeable terms in QAPPs. Accuracy is the extent of the agreement between an observed value (sample result) and the true value of the parameter being measured. As indicated in the SOPs provided in Appendix C accuracy in the lab will be determined through completion of spiked samples for the nutrient parameters (TKN, NH₃-N, NO₂+NO₃-N, TP, dissolved Ortho P), and TOC. Accuracy for the BOD test will be determined using an Alpha-Trol standard. Accuracy for TSS will be determined by the percent recovery of a known standard.

Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of a site. Sample locations were chosen to facilitate computer modeling of the river using the QUAL2E dissolved oxygen model. Reaches were selected based on the location of significant inputs and river characteristics. Stations were selected just upstream of each reach and near the downstream end of the reach (which served as the upstream station for the next reach). In addition major contributors of flow and/or pollutants which may impact dissolved oxygen were sampled such as major tributaries and wastewater treatment facility discharges.

Comparability is the extent to which data from one study can be compared directly to either past data from the current project or data from another study. Using standardized sampling and analytical methods, units of reporting, and site selection procedures help insure comparability. Comparability between samples for this project will be achieved through maintaining consistency with SOPs, sampling locations, and sampling methods. Modifications to some of the SOP's implemented in 2001 have been made for the 2002 sampling season in order to reduce the potential for errors being made in sample collection and analysis. The improvements will increase the precision and accuracy of the data collected and do not significantly affect the comparability of the data. The protocol for collecting water samples for this project is similar but not exactly the same as many of the sampling protocols used by the NH Rivers Ambient Monitoring Program. Chemical analyses will be done according to standard methods followed by the NHDES Laboratory which has been used by the NH Rivers Ambient Monitoring Program. Many of the sample locations are similar to those sampled by the NH Rivers Ambient Monitoring Program and with the Wasteload Allocation Study for the Ashuelot River conducted by NHDES in 1989.

Sensitivity is the ability of the method or instrument to detect the contaminant of concern and other target compounds at the level of interest. Background information for many of the proposed sampling locations exist, and the data show that the methods and instruments are able to detect the analyte of concern and other target compounds at the level of interest. Detectable ranges of the methods and the equipment (as shown in methods and SOPs) are adequate for the purposes of this study design. Method Detection Limits and Lab Quantitation Limits are shown in Table 8.

Quantitation Limits. The analytical method, analytical/achievable method detection limit, and the analytical/achievable laboratory quantitation limits for this project are shown below in Table 8. Analytical method MDLs and QLs are documented in validated methods. Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Completeness is a measure of the number of samples you must take to be able to use the information, compared to the number of samples you originally planned to take. The guidelines and protocols for the sampling procedures, when followed, will yield more than adequate sample quantities for analysis. Of the 19 proposed sampling stations, 14 are considered critical for developing effluent limits for the Keene and West Swanzey WWTFs. These include all sampling stations from 17-Ash located just downstream of Route 101 to 14-Ash located just downstream of the West Swanzey WWTF. Assuming 2 rounds of sampling, completeness for these stations are set at 100% (excluding pH and conductivity which are not needed for the model). If 100% criteria is not able to be met, depending on availability of resources, additional rounds of sampling would be scheduled. If additional resources are not available or if

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schedules do not allow for additional rounds of sampling, the model will be run with the available data. The remaining sampling stations are not considered critical; completeness for these stations is set at 50% assuming two sampling rounds.

Contamination: To determine if significant contamination has occurred in the field and/or in the laboratory, field and lab blanks will be run.

Table 8. Surface Water Target Analytes and Reference Limits (based on EPA Worksheet # 9b)

Analyte (Medium /Matrix)	Regulatory Project Action Limits	Technical Project Quantification Limits	Analytical method ⁽¹⁾	Analytical/ Achievable Method Detection Limit	Analytical/ Achievable Laboratory Quantitation Limit
Laboratory					
BOD (5 day and 20 day) (Water)	NA	3 mg/L	C-3	NA	3 mg/L
TKN (Water)	NA	0.1 mg/L	C-6	0.1 mg/L	0.1 mg/L
NH3-N (Water)	NA	0.1 mg/L	C-4	0.018 mg/L	0.1 mg/L
NO2+NO3-N (Water)	NA	0.05 mg/L	C-5	0.012 mg/L	0.05 mg/L
TP (Water)	NA	0.005 mg/L	C-8	0.0008 mg/L	0.005 mg/L
Dissolved PO4-P (Water)	NA	0.010 mg/L	C-7	0.004 mg/L	0.010 mg/L
Chlor a (Water)	NA	0.50 mg/m ³	C-11	0.32 mg/m ³	0.50 mg/m ³
TSS (Water)	NA	2 mg/L	C-9	NA	2 mg/L
TOC (Water)	NA	0.5 mg/L	C-10	0.24 mg/L	0.5 mg/L
Field					
Temperature (Water)	NA	-5 deg C to 30 deg C	Hand meter B-2 Hydrolab B-5	NA	NA
Dissolved Oxygen (Water)	NA	0.5 mg/L	Hand meter B-2 Hydrolab B-5	NA	NA
pH (Water)	NA	2-12 units	Hand meter B-3 Hydrolab B-5	NA	NA
Conductivity (Water)	NA	0-1000 ms/cm	Hand meter B-4 Hydrolab B-5	NA	NA
Flow (Water)	NA	0 – 50 cfs	Hand meter B-6	NA	NA

Notes:

1. See Appendix B for Field and Appendix C for Laboratory Standard Operating Protocols.

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Table 9 summarizes the performance criteria for samples collected for this project.

Table 9. Measurement Performance Criteria for Surface Water Samples (based on EPA Worksheet # 11b)

Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance
Precision-Field	<p>Temperature +/- 0.5 degrees C</p> <p>Dissolved Oxygen +/- 0.2 mg/L</p> <p>pH +/- 0.5 units</p> <p>Conductivity RPD \leq 35%</p> <p>BOD & TSS</p> <p style="padding-left: 40px;">From 0 to 5 +/- 3 mg/L</p> <p style="padding-left: 40px;">From >5 to 10 +/- 4 mg/L</p> <p style="padding-left: 40px;">From > 10 to 30 +/- 6 mg/L</p> <p>TKN RPD \leq 35%</p> <p>NH₃-N RPD \leq 35%</p> <p>NO₂+NO₃-N RPD \leq 35%</p> <p>TP RPD \leq 35%</p> <p>Dissolved Ortho P RPD \leq 35%</p> <p>TOC RPD \leq 35%</p> <p>Chlor a From 0 to 5 +/- 2.0 mg/m³</p> <p style="padding-left: 40px;">From >5 to 10 +/- 3.5 mg/m³</p> <p style="padding-left: 40px;">From >10 to 30 +/- 5.0 mg/m³</p>	Field Duplicates
Precision-Lab	<p>It is the practice of the NHDES Lab to always run independent calibration with every test as a way to assess accuracy. The lab assesses precision with lab duplicates. A description of the standardized quality control sequence is provided in Section 13.2.2. Acceptable ranges of differences between lab duplicates for TP, Dissolved Orthophosphorus, TKN, NH₃-N, NO₂+NO₃-N, BOD, TOC and TSS are shown in Table 18 in Section 13.2.2. The acceptable range is between the Lower Control Limit and the Upper Control Limit for the lab duplicates.</p> <p>For Chlor a, the acceptance limits are as follow:</p> <p style="padding-left: 40px;">From 0 to 5 , acceptance limit is +/- 1.01</p> <p style="padding-left: 40px;">From >5 to 10, acceptance limit is +/- 1.7</p> <p style="padding-left: 40px;">From >10 – 30, acceptance limit is +/- 2.84</p>	Lab duplicates

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Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance
Accuracy/Bias	It is the practice of the NHDES Lab to always run independent calibration with every test as a way to assess accuracy. The lab also assesses accuracy with lab fortified matrix (LFM). A description of the standardized quality control sequence is provided in Section 13.2.2. Acceptable ranges are shown in Table 18. The acceptable range is between the Lower Control Limit and the Upper Control Limit for the LFM.	Spiked samples (Lab fortified matrix)
Sensitivity	See Table 8 for Method Detection Limits and Quantitation limits.	MDLs and QLs
Data Completeness	Assuming 2 rounds of sampling, 100% data completeness (excluding pH and conductivity) for 12 critical stations (17Ash through 14 Ash). For remaining non-critical stations, 50% data completeness.	Data Completeness Check
Field Contamination Lab Contamination	\leq Project Quantitation Limit (QL) (see Table 8) \leq Lab Quantitation Limit (QL) (see Table 8)	Field Blanks Lab Blanks

8.0 Sampling Process Design (Experimental Design)

This section describes the sampling rationale and procedures.

8.1 Sampling Design Rationale

Weather permitting, NHDES will conduct two or three dry weather sampling events along the Ashuelot River in the summer of 2001 (July through September) to provide data necessary to complete this TMDL study. Table 10 includes the sample locations, the parameters that will be sampled, and the rounds that will be sampled. The notes accompanying Table 10 provide additional details regarding the sampling program. A plan showing the locations of the sampling stations is provided in Appendix A. Table 11 provides information regarding the number of sample bottles that will be analyzed and the number of field measurements which will be taken.

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Table 10: Sampling Stations and Parameters (see notes below)

Waterbody	Station ID	Description	Flow ³	Field Measurements ⁴	Lab Samples ⁵	Hydrolab ⁶
Ashuelot River	21-Ash	Surry Mountain Road Bridge, Surry		1,2,3	1,2,3	
Ashuelot River	20A-Ash	Stone Arch Bridge located ~ 200 feet upstream of Rte 12 A Bridge, Keene	1,2,3	1,2,3	1,2,3	
Ashuelot River	19A-Ash	Foot suspension bridge across impoundment upstream of ~ 8 foot high dam upstream of West Street bridge, Keene.		1,2	1,2,3	3
Ashuelot River	19-Ash	West Street Bridge , Keene		1,2,3	1,2,3	
Ashuelot River	17-Ash	Stone Arch Bridge off of Martel Road on the south of Rte 101, Keene.	1,2,3	1,2,3	1,2,3	
The Branch River	0A-Bra	Approximately 100 feet upstream of confluence with Ashuelot River (behind pump station off of Martel Avenue)	1,2,3	1,2,3	1,2,3	
Ashuelot River	16M-Ash	~ 50 feet upstream of Ash Swamp Brook confluence, Keene.		2,3	1,2,3	1
Ash Swamp Brook	0A-Asb	Bridge over old railroad bed approximately 200 feet upstream of confluence with Ashuelot River, Swanzey.	1,2,3	1,2,3	1,2,3	
Ashuelot River	16D-Ash	~ 50 feet upstream of the Keene WWTF outfall, Swanzey.	1,2,3	1,2,3	1,2,3	1,2,3
Keene WWTF	Keene WWTF discharge	Keene WWTF outfall, Swanzey	1,2,3 (by WWTF)	1,2,3	1,2,3	
Ashuelot River	16B-Ash	Just downstream of Keene WWTF and upstream of S. Branch Ashuelot River, Keene.		1,2,3	1,2,3	1,2,3
South Branch Ashuelot River	2-Sba	Rte 32 bridge. Park on southwest side. Take sample from walkway on upstream side of bridge.	1,2,3	1,2,3	1,2,3	
Ashuelot River	16-Ash	~ 100 feet upstream of Sawyers Crossing Road bridge (covered bridge called Cresson Bridge) just downstream of S. Branch Ashuelot River confluence, Swanzey.		1,2,3	1,2,3	
Ashuelot River	15E-Ash	Adjacent to Rte 10		1,2,3	1,2,3	
Ashuelot River -	15-Ash	Covered bridge over Homestead Woolen Dam Impoundment		1, 2,3	1,2,3	2
Ashuelot River	14T-Ash	Denman Thompson Highway bridge. Sample on upstream side.	1,2,3	1,2,3	1,2,3	1,2,3

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Waterbody	Station ID	Description	Flow ³	Field Measurements ⁴	Lab Samples ⁵	Hydrolab ⁶
W. Swanzey WWTF	W. Swanzey WWTF discharge	Access to WWTF is from Denman Thompson Highway. Install composite sampler in red chlorine contact building.	1,2,3 (by WWTF)	1,2,3	1,2,3	
Ashuelot River	14-Ash	~ 100 feet upstream of covered bridge (under construction), Swanzey		1,2,3	1,2,3	1,2,3
Ashuelot River	12-Ash	Coombs Road covered bridge, Winchester.	1,2,3	1,2,3	1,2,3	

Notes:

1. Weather permitting, a minimum of two rounds will be sampled, during dry weather low flow conditions (i.e., critical flow conditions). It is hoped, however that three rounds will be collected.
2. Critical flow conditions are defined as when flow in the river is no more than three times the 7Q10 low flow and when it has rained no more than 0.25 inches during a three day period prior to sampling. It is during these times when pollutants exert their greatest impact on dissolved oxygen. Determination of flow conditions will be based on a check of gage readings just below the Surry Mountain Dam and in West Swanzey on the Ashuelot River. Determination of rainfall will be based on rain gage readings at the Keene WWTF.
3. Flow measurements will be taken on the same day as lab samples at selected locations. WWTF discharge flows will be based on automatic flow recorders at the WWTFs.
4. For river samples, buckets will be used to carefully collect grab samples from the top 6 inches of the surface water for field measurements and laboratory samples. Samples will be taken as close to midstream as possible. The location of the sample in relation to the bank and center of stream will be documented on the field data sheets. Water from the buckets will be transferred to appropriate containers and preserved appropriately for transport to the laboratory that day. Dissolved orthophosphorus samples will be filtered in the field. Twenty day BOD analyses will be run on the river samples.
5. For WWTF effluent samples, a 24 hour flow composite sample will be taken beginning around noon of the day before sampling occurs at all other stations. The composite sample will then be transferred in the field to appropriate bottles for lab analyses. Field measurements of dissolved oxygen, temperature, pH, and conductivity of the WWTF discharges will be based on grab samples (bucket) from the outlet side of the disinfection tanks. Five and 20 day BOD samples will be run on all WWTF effluent samples.
6. Two rounds of field measurements will be taken on the same day that lab samples are collected. An early round of field measurements (focus on temperature and dissolved oxygen) will be collected prior to 8 am when dissolved oxygen is expected to be lowest. A full round of field measurements (dissolved oxygen, temperature, pH and specific conductivity) will also be collected later in the day (between mid-morning and early afternoon) when lab samples are collected.. This will also provide an indication of diurnal variability of dissolved oxygen due to photosynthesis and respiration. At impoundments stations, dissolved oxygen and temperature measurements will be taken at the surface as well as within approximately 1 foot of the bottom. For the lower depth of impoundments, DO/Temperature measurements will be taken directly in the river and not from bucket samples.
7. Lab samples include biochemical oxygen demand (5 day and 20 day BOD), total phosphorus, dissolved orthophosphorus, ammonia nitrogen, nitrite and nitrate nitrogen, total kjeldahl nitrogen, total suspended solids, total organic carbon, and chlorophyll a.
8. Hydrolabs will be deployed if there is adequate flow and depth in the river (i.e., greater than 0.5 feet deep). These units will automatically take continuous readings of dissolved oxygen, temperature, specific conductivity and pH. If there is insufficient depth for deployment of hydrolabs, individual field measurements will be taken as previously described. In addition, effort will be made to have these units installed during at least one rain event to get an indication of how dissolved oxygen levels in the main stem of the Ashuelot River respond to wet weather events.

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9. Weather permitting, one round of sediment oxygen demand (SOD) tests at selected locations, is expected to be conducted in the summer of 2002 under similar critical flow and rainfall conditions. An addendum to the QAPP will be submitted at a later date for this work.

Table 11. Surface Water Field Sample Summary (based on EPA Worksheet #9c)

Analyte	No. of sampling locations	No. of samples per round	Number of field duplicates per round (10%)	Number of sample blanks per round (10%)	Number of samples or measurements per round	Maximum Number of rounds	Total number of samples or measurements
Laboratory Samples							
BOD (5 and/or 20 day)	19	19	2	2	23	3	69
TKN	19	19	2	2	23	3	69
NH3-N	19	19	2	2	23	3	69
NO2+NO3-N	19	19	2	2	23	3	69
TP	19	19	2	2	23	3	69
Dissolved PO4-P	19	19	2	2	23	3	69
Chlor a	19	19	2	2	23	3	69
TSS	19	19	2	2	23	3	69
Field Measurements							
Temperature	19	19	2	NA	21	3	63
Dissolved Oxygen	19	19	2	NA	21	3	63
PH	19	19	2	NA	21	3	63
Specific Conductivity	19	19	2	NA	21	3	63
Flow	8	8	1 duplicate velocity and depth reading	NA	8	3	24

9.0 Sampling Procedures and Requirements

9.1 Sampling Procedures

Standardized sampling procedures provide consistency between samplers; facilitate collection of accurate, precise, and representative samples; and help to ensure data comparability. Table 12 provides a summary of sample requirements. Table 13 includes references to pertinent Standard Operating Protocols (SOPs).

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Table 12. Sample requirements (based on EPA Worksheet #12b)

Analytical parameter	Collection method ¹	Sampling SOP	Sample volume	Container size and type	Preservation requirements ³	Max. holding time (preparation and analysis)
BOD (5 and/or 20 day)	Grab	See Table 13	500 mL	1.6 L (1/2 gal), white polyethylene	Chilled to 4°C	48 hours
TSS	Grab	See Table 13	100 mL	Same bottle as BOD	Chilled to 4°C	7 days
NO ₂ +NO ₃ -N	Grab	See Table 13	50 mL	Same bottle as BOD	Chilled to 4°C	48 hours
TKN	Grab	See Table 13	20 mL	250 mL brown polyethylene	0.5 mL of 9N H ₂ SO ₄ to pH<2, chilled to 4°C	28 days
NH ₃ -N	Grab	See Table 13	50 mL	Same bottle as TKN	0.5 mL of 9N H ₂ SO ₄ to pH<2, chilled to 4°C	28 days
TP	Grab	See Table 13	50mL	Same bottle as TKN	0.5 mL of 9N H ₂ SO ₄ to pH<2, chilled to 4°C	28 days
Dissolved PO ₄ -P	Grab	See Table 13	50 mL	50 ml clear polyethylene container	Field filtered through 0.45 um filter, Chilled to 4°C	48 hours
Chlor a	Grab	See Table 13	500 mL	1 L brown polyethylene	Light protected, Chilled to 4°C	24 hours
TOC	Grab	See Table 13	80 mL	2-40 mL glass vials	0.5 mL of 9N H ₂ SO ₄ to pH<2, chilled to 4°C	28 days

Notes:

- Grab samples will be taken at all stations except the WWTF discharges which will be based on 24 hour flow composite samples. Holding times for WWTF composite samples begin from the time the first aliquot of the composite is taken.
- Samples for BOD, TSS and NO₂+NO₃-N will be taken from 1-1.6L white polyethylene bottle
Samples for TKN, NH₃-N, and TP will be taken from 1- 250 mL brown polyethylene bottle.
Samples for Dissolved PO₄-P will be from 1- 50 mL clear polyethylene bottle
Samples for Chlor a will be taken from 1-1L brown polyethylene bottle.
Samples for TOC will be taken from 2-40 ml glass vials.
(The total number of sample containers per station (excluding duplicates or blanks) is therefore 6.)
- For TKN, NH₃-N, TP and TOC, 0.5 mL of 9N H₂SO₄ is added to the appropriate bottle(s) in the laboratory prior to collecting the sample. This dose of acid will preserve the sample to a pH of less than 2 as required.

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Table 13. Project Sampling SOP Reference Table (based on EPA Worksheet #13)

SOP Reference Number	SOP Title	Originating Organization	Equipment Identification	Modified for the Project?
C-3	Biochemical Oxygen Demand (BOD)	NHDES	Laboratory Equipment/ Manual DO probe	N
C-4	Ammonia (NH ₃ -N)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-5	Nitrite + Nitrate Nitrogen (NO ₂ + NO ₃ -N)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-6	Total Kjeldahl Nitrogen (TKN)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-7	Orthophosphate phosphorus (PO ₄ -P)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-8	Total Phosphorus (TP)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-9	Total Suspended Solids (TSS)	NHDES	Laboratory Equipment/Gravimetric	N
C-10	Total Organic Carbon (TOC)	NHDES	Laboratory Equipment/TOC Autoanalyzer	N
C-11	Chlorophyll a (chlor a)	NHDES	Laboratory Equipment/Spectrometer	N
B-1	Sampling SOP	NHDES	NA	N
B-7	ISCO Automatic Composite Sampler	NHDES	NA	N

9.2 Sampling SOP Modifications

No sampling SOPs were modified to meet the project quality objectives.

9.3 Cleaning and Decontamination of Equipment/Sample Containers

Cleaning and decontamination of field sampling equipment is discussed in Section 9.5. Cleaning and decontamination of field analytical equipment is discussed in Section 11.4.

9.4 Field Equipment Calibration

See Section 11.

9.5 Field Equipment Maintenance, Testing and Inspection Requirements

See Section 11.

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9.6 Inspection and Acceptance Requirements for Supplies/Sample Containers

Supplies and sample containers for this project will be examined by the project manager and/or field coordinator prior to use. Extra sample supplies and containers will be brought in the field in the event that contamination or damage of another container occurs.

10.0 Sample Handling, Tracking and Custody Requirements

10.1 Sample Collection Documentation

This section describes field documentation procedures that will be followed for the project. Proper field sampling documentation help to ensure sample authenticity and data integrity.

10.1.1 Field Notes

Field notes will be taken on NHDES issued field data sheets, examples of which are provided in Appendix D.

10.1.2 Field Documentation Management System

Field sheets will be used as described above. Monitoring staff will complete each task specific sheet in the field and turn them in to the Project Manager when samples are returned to the laboratory. The Project Manager will be responsible for tracking these field sheets.

10.2 Sample Handling and Tracking System

In the field: Sample bottles are labeled in the field with the waterbody name, the sample station identification number, sample date, sample time, the collector's initials and the parameters to be analyzed. In addition to the above information, duplicates will be designated with a D1, and D2, to indicate the order in which they were taken. Sample bottles for TKN, NH₃-N, TP, and TOC will be acidified in the lab prior to going out in the field as indicated in Table 12. Blanks will be designated with the letter "B". Water samples will be iced immediately after collection and transported by a member of the sampling team to NHDES.

In the Laboratory Services Unit laboratory: All samples are logged into a computer database which assigns a number and prints out a label for each logged sample. The label contains sample date and time of collection.

In the Limnology laboratory: After being logged into the Laboratory Services Unit laboratory database, chlorophyll a samples are logged into the Limnology laboratory database which assigns a number and prints out a label for each logged sample. The label contains information such as waterbody name/town, sample location, sample date, sample time, collector's initials, log-in date and time, and the parameters to be run on the sample. This login system also assigns a number to the sample which is tracked through both the Limnology Center Laboratory and the Laboratory Services Unit. These numbers are assigned in consecutive order in a database as samples are logged in, starting with the year, followed by the sample number in the system (2002-XXXX).

All samples are kept at 4°C in the field and between laboratories. In the Limnology Center samples are warmed to 25°C for analyses. See Table 12 (EPA worksheet 12b) or Appendix B and C for sample container, volume, and preservation information and holding time information.

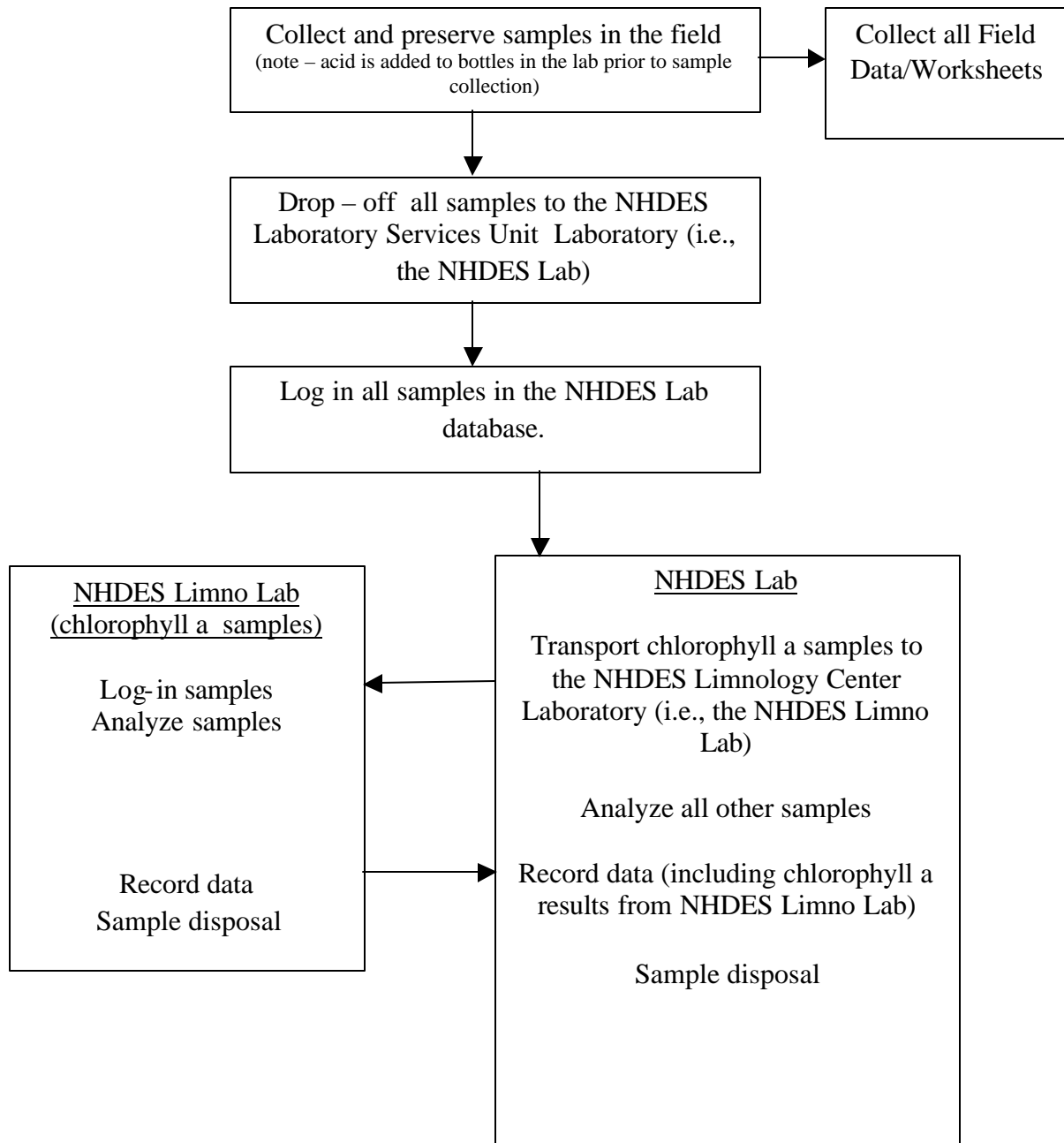
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Figure 2 summarizes the sampling handling, tracking, and custody channel that all samples go through. Sample disposal is down the sink unless otherwise specified in the SOPs in Appendix C (most are just surface water samples).

Figure 2: Sampling Handling/Tracking/Custody Summary



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10.3 Sample Custody

See section 10.2 and Figure 2.

11.0 Field Analytical Method Requirements

This section describes the analytical techniques that will be used in the field to generate data for this project. It documents the field analytical methods and SOPs that will be used to meet measurement performance criteria and achieve project quantitation limits.

11.1 Field Analytical Methods and SOPs

SOPs for field analytical methods may be found in Appendix B and are summarized in Table 14.

Table 14. Field Analytical Method/SOP Reference Table (based on EPA Worksheet #20)

SOP Reference Number	SOP Title	Originating Organization	Equipment Identification	Modified for the Project?
B-2	Temperature / Dissolved Oxygen	NHDES	Meter	N
B-3	pH	NHDES	Meter	N
B-4	Conductivity	NHDES	Meter	N
B-5	Hydrolab	NHDES	Multi-probe	N
B-6	Flow	NHDES	Meter	N

11.2 Field Analytical Method/SOP Modifications

No modifications to methods or SOPs will be made for this project.

11.3 Field Analytical Instrument Calibration

Information regarding calibration of field analytical equipment is provided in the SOPs in Appendix B and in Table 15.

Table 15. Field analytical equipment calibration table (based on EPA Worksheet # 14)

Equipment name	Procedure and SOP Reference	Frequency of calibration	Acceptance criteria	Corrective action	Person responsible
YSI Model 95: Temperature / Dissolved Oxygen meter	B-2	Each use	+/- 0.2mg/L or +/- 2% of saturation, whichever is greater	Check battery, Wet sponge, Check for bubbles Recalibrate	Field Coordinator
Orion Model 210A Meter and Triode Model 91-57BN Electrode: pH	B-3	Each use	Slope value 92%- 102%	Check battery, Replenish electrode filling solution if necessary, Clean electrode Recalibrate	Field Coordinator

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Equipment name	Procedure and SOP Reference	Frequency of calibration	Acceptance criteria	Corrective action	Person responsible
YSI Model 30: Conductivity meter	B-4	Each use	N/A	Check battery, Clean electrode, Recalibrate	Field Coordinator
Hydrolab Multi-probe meter	B-5	Each use	pH +/- 0.2 units DO +/- 0.2 mg/L Conductivity +/- 1% change Temperature +/- 0.10 degrees C	Check battery, Recalibrate, Send meter back if it won't calibrate	Field Coordinator
Flow meter	B-6	Each use	<0.05 cfs in standing water	Check battery Recalibrate Send meter back if it won't calibrate	Field Coordinator

*Note: YSI Model 30 comes factory calibrated. The factory calibration is verified (meter accuracy) by using a 200 uS/cm standard according to the SOP B-4 in Appendix B.

11.4 Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Requirements

Table 16 shows the procedures and documentation activities that will be performed to ensure that all field analytical instrumentation and equipment are available and in working order when needed.

Table 16. Field Analytical Equipment Maintenance, Testing, and Inspection (based on EPA Worksheet #19)

Equipment name	Activity	Frequency of activity	Acceptance criteria	Corrective action	Person responsible
Temperature / Dissolved Oxygen meter	Change battery if low, Inspect and change membrane if needed.	Prior to each use	Proper calibration	Send back to company	Field Coordinator
pH meter	Change battery if low.	Prior to each use	Proper calibration	Send back to company	Field Coordinator
Conductivity meter	Change battery if low	Prior to each use	Proper calibration	Send back to company	Field Coordinator
Hydrolab Multi-probe meter	Change battery if low, Inspect and change membrane if needed	Prior to each use	Proper calibration	Send back to company	Field Coordinator
Flow meter	Change battery if low	Prior to each use	Proper calibration	Send back to company	Field Coordinator

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11.5 Field Analytical Inspection and Acceptance Requirements for Supplies

All necessary supplies are already acquired and are in ample abundance for the requirements of this study. All equipment is maintained before and immediately following each use to assure availability upon need. The field coordinator will be responsible for inspection and maintenance of supplies for field analytical equipment.

12.0 Fixed Laboratory Analytical Method Requirements

This section of the QAPP describes the analytical techniques that will be used by the fixed laboratory to generate data for the project. Methods are analytical techniques used to identify and quantify the target analytes. Analytical SOPs document how a particular laboratory will perform a specific analytical method.

12.1 Fixed Laboratory Analytical Methods and SOPs

Table 17 provides a summary of Fixed Laboratory Method/SOPs. Complete fixed laboratory SOPs may be found in Appendix C.

Table 17: Fixed Laboratory Method/SOP Reference Table (based on EPA Worksheet # 20)

Reference Number	Title	Originating Organization	Equipment Identification	Modified for the Project Work
C-3	Biochemical Oxygen Demand (BOD)	NHDES	Laboratory Equipment/ Manual DO probe	Y
C-4	Ammonia (NH ₃ -N)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-5	Nitrite + Nitrate Nitrogen (NO ₂ + NO ₃ -N)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-6	Total Kjeldahl Nitrogen (TKN)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-7	Orthophosphorus (PO ₄ -P)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-8	Total Phosphorus (TP)	NHDES	Laboratory Equipment/Autoanalyzer	N
C-9	Total Suspended Solids (TSS)	NHDES	Laboratory Equipment/Gravimetric	N
C-10	Total Organic Carbon (TOC)	NHDES	Laboratory Equipment/TOC Autoanalyzer	N
C-11	Chlorophyll a (chlor a)	NHDES	Laboratory Equipment/Spectrometer	N

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12.2 Fixed Laboratory Analytical Method/SOP Modifications

The fixed laboratory analytical methods or SOP for BOD was slightly modified for this project. For BOD the SOP was modified to reflect that readings for river samples will be taken after 20 days and that readings for WWTF samples will be taken after 5 and 20 days. In addition, NO₂+NO₃-N readings will be taken at the beginning of the BOD tests and when BOD readings are taken. This information is needed to calculate the carbonaceous oxygen demand.

12.3 Fixed Laboratory Instrument Calibration

Calibration information for each of the tests shown in Table 17 is included with each of the SOPs provided in Appendix C. Fixed laboratory instrument calibration is performed on a daily basis by the laboratory analyst.

12.4 Fixed Laboratory Instrument/ Equipment Maintenance, Testing and Inspection Requirements

The NHDES Laboratory performs routine maintenance and repairs on its instrumentation. Entries are made into maintenance logs for each instrument.

12.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies

All necessary supplies are already acquired and are in ample abundance for the requirements of this study. All equipment is maintained before and immediately following each use to assure availability upon need. SOPs for cleaning and preparing sample containers for reuse are included in Appendix C (SOP C-1).

13.0 Quality Control Requirements

This section of the QAPP identifies the QC procedures, checks, samples, and acceptance limits that will be used during the project.

13.1 Sampling Quality Control

Sample collection:

Field duplicate pairs will be collected on at least 10% of all samples or at least once per every field sampling event, whichever is more. Precision will be determined as shown in Table 9. If results exceed the acceptable precision limits shown in Table 9, the sample result will be considered questionable, and the Project Manager will consult with the DES lab manager to determine if the quality of the data has been compromised, in which case the results will not be used.

Field blanks (at least one per sampling event or at least 10% of all samples, whichever is more) will be also be prepared in the field to determine if sample contamination has occurred. Deionized water from the lab will be brought to the field to prepare the blanks. One set of field blanks will be prepared by rinsing one of the buckets used to collect river water three times with deionized water. The bucket will then be filled again with deionized water and poured into sample bottles. The other field blank will be prepared by pouring deionized water directly into the sample bottles. Collection of field blanks in this manner will help determine if the source of contamination, if any. If results exceed those shown in Table 9, the results will be flagged and the Project Manager will consult with the Field Project Officer and DES lab manager to determine if sampling protocols need to be revised.

Lab duplicates and blanks will also be prepared to determine if contamination has occurred in the lab. Acceptance criteria are presented in Table 9.

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Field Measurements (hand meters):

For field measurements using any of the hand-held meters (dissolved oxygen/temperature, pH, conductivity, flow), duplicate analyses will be performed on at least 1 or 10% of all samples (whichever is more). If the two readings are off by more than the values shown in Table 9, the field personnel will discuss the procedures with the Project Manager until an understanding is reached. The measurement may be discarded or one kept depending on the result of the conversation. The Dissolved Oxygen meter and pH meters will be calibrated prior to each sample being tested and the calibration will be checked at the end of the sampling day.

Field Measurements (hydrolab):

Hydrolabs will be calibrated before deployment and the calibration will be checked after deployment. Immediately after deployment and prior to retrieving hydrolabs, a hand-held dissolved oxygen meter will be used to measure the dissolved oxygen and temperature. The time will also be recorded. This data will be compared to the hydrolab results to determine if “drift” has occurred. If results are within 0.5 ppm and the hydrolab meter calibrates properly after retrieval the hydrolab data will be considered valid. If results exceed these limits, and/or if the hydrolab does not calibrate after retrieval, the Project Manager will be alerted and the hydrolab data will be flagged as questionable.

13.2 Analytical Quality Control

This section of the QAPP identifies the QC procedures, checks, and samples, and their respective acceptance limits that will be used during the project

13.2.1 Field Analytical QC

See Section 13.1.

13.2.2 Fixed Laboratory QC

NH DES laboratory QC procedures are fully described for each analyte in the fixed laboratory SOPs included in Appendix C. Acceptance criteria are provided in Table 9. A summary of the standardized quality control sequence for the NHDES lab is provided below:

NHDES LAB STANDARDIZED QUALITY CONTROL SEQUENCE:

The following is a summary of terms used to describe the NHDES Lab Standardized Quality Control Sequence:

Cal. Blank	= calibration blank, DI water
RDL	= Reporting Detection Limit
ML	= Minimum Level
MDL	= Method Detection Level
LCS	=Low Calibration Standard
MPCS	= Midpoint Calibration Standard
HCS	= High Calibration Standard
ICV	= Independent Calibration Verification
LRB	= Laboratory Reagent Blank
LFB	= Laboratory Fortified Blank
1.0 NO2	= 1.0 mg/L NO2 standard to check column efficiency
CCB	= Continuing Calibration Blank
CCV	= Continuing Calibration Verification
LFMS	= Lab Fortified Matrix Spike

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Initial Calibration Curve (consists of a blank and at least 3 standards)

FOLLOWED BY:

1. Cal. Blank (must be less than MDL)
2. LCS = ML \pm 20%
3. MPCS = CCV \pm 5 % at beginning of run and \pm 10% at end of run as CCV
4. HCS = \pm 5% at beginning of run , \pm 10% at end of run
5. ICV (Quality Control Sample made from second source material) = \pm 10%
6. LRB must be less than MDL. Will usually be the same as the Cal. Blank.
7. LFB (made from second source (ICV))= \pm 10%
8. 1.0 mg NO₂/L column check, \pm 20% (for NO₃+NO₂ only)

Sequence of Samples:

1. Run samples 1-4,
2. Run Duplicate
3. Run samples 6-9
4. Run LFMS
5. Run Cal. Blank (must be less than MDL)
6. Run CCV (must be \pm 10%)
7. Run the rest of samples in batches of 10 using the same sequence.

At the end of the last set of samples: :

1. Run Cal. Blank (must be less than MDL)
2. Run LCS (must be \pm 20%)
3. Run CCV (must be \pm 10%)
4. Run HCS (must be \pm 10%)

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Table 18: NHDES Laboratory Analysis QC Sample Table for BOD (5 and 20 day)

(based on EPA-NE QAPP worksheet #24a)

Analytical Method/SOP Reference : Appendix C-3		Measurement Performance Criteria : <u>Standard Methods # 5210B</u>		Number of Samples : _____	
Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptable Limits	Corrective Action (CA)	Person(s) Responsible For CA	Data Quality Indicator (DQI)
Method Blank	NA	NA	NA	NA	NA
Reagent Blank (Dilution Water)	1/run	<0.2 mg/l	Report qualified data or invalidate data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Contamination
Instrument Blank	NA	NA	NA	Na	NA
Laboratory Duplicates	1/batch	Range: 0-0.38 mg/l	Report qualified data or invalidate data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Precision
Laboratory Matrix Spike	1/batch per matrix	Recovery: 88% - 131%	Report qualified data or invalidate data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Interferences
Laboratory Control Sample	1/batch	LCS = 3.3 +/- 10%	Report qualified data or invalidate data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy
Laboratory Fortified Blank	NA	NA	NA	NA	NA
Bottle Blank	1/run	<2 mg/l	Report qualified data or invalidate data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Contamination

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Table 19: NHDES Laboratory Analysis QC Sample Table for Ammonia Nitrogen (NH₃ N)

(based on EPA-NE QAPP worksheet #24a)

Analytical Method/SOP Reference : Appendix C-4		Measurement Performance Criteria : <u>Standard Methods # 4500NH₃ -B.& G</u>		Number of Samples : _____	
Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptable Limits	Corrective Action (CA)	Person(s) Responsible For CA	Data Quality Indicator (DQI)
Method Blank	1 at beginning, end and every 10 samples	<RL	Invalidate data run and repeat	Analyst, Inorganic Supervisor, Quality Control Supervisor	Method performance contamination drift
Reagent Blank	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA
Laboratory Duplicates	1 every 10 samples	0 – 0.36 mg/l		Analyst, Inorganic Supervisor, Quality Control Supervisor	Precision
Laboratory Matrix Spike	1 every 10 samples	Recovery: 84 – 119%	Re-run, qualify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Matrix effects (interference)
Laboratory Control Sample	1/run	4.11(+/- 10%) 8.22 (+/- 10%)	Re-analyze a fresh aliquot or Re-run whole run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy
Laboratory Fortified Blank	1/run	1.0 +/- 10%	Re-analyze a fresh aliquot or Re-run whole run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy and methods performance
Continuing Calibration Verification (mid-point calibration standard)	1 every 10 samples	10 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy and methods performance

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Table 20: NHDES Laboratory Analysis QC Sample Table for Nitrite and Nitrate Nitrogen (NO₂&NO₃) - N

(based on EPA-NE QAPP worksheet #24a)

Analytical Method/SOP Reference : Appendix C-4		Measurement Performance Criteria : <u>EPA 353.2 by Lachat 10-107-04-1-A</u>		Number of Samples : _____	
Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptable Limits	Corrective Action (CA)	Person(s) Responsible For CA	Data Quality Indicator (DQI)
Method Blank	NA	NA	NA	NA	NA
Reagent Blank	1 at beginning, end, and every 10 samples	<RL	Invalidate run and repeat	Analyst, Inorganic Supervisor, Quality Control Supervisor	Drift, contamination, method performance
Instrument Blank	NA	NA	NA	NA	NA
Laboratory Duplicates	1 every 10 samples	0 – 0.023 mg/l	Repeat, quantify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Precision
Laboratory Matrix Spike	1 every 10 samples	92 – 108%	Repeat, quantify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Matrix interference
Laboratory Control Sample	1/run	2.5 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy
Laboratory Fortified Blank	1/run	1.5 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Method Performance/ Accuracy
Continuing Calibration Verification (mid-point calibration standard)	1 every 10 samples	6.25 +/- 10%	Re-run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Method Performance/ Accuracy

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Table 21: NHDES Laboratory Analysis QC Sample Table for Total Kjeldahl Nitrogen (TKN-N)

(based on EPA-NE QAPP worksheet #24a)

Analytical Method/SOP Reference : Appendix C-5		Measurement Performance Criteria : <u>EPA 351.2 by Lachat 10-107-06-2-E</u>		Number of Samples : _____	
Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptable Limits	Corrective Action (CA)	Person(s) Responsible For CA	Data Quality Indicator (DQI)
Method Blank	1 at beginning, end and every 10 samples	<RL	Invalidate run and repeat	Analyst, Inorganic Supervisor, Quality Control Supervisor	Contamination, method performance, drift
Reagent Blank	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA
Laboratory Duplicates	1 every 10 samples	0 – 0.07 mg/l	Repeat, qualify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Precision
Laboratory Matrix Spike	1 every 10 samples	75 – 119%	Repeat, qualify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Matrix /effect
Laboratory Control Sample	1/run	3.5 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy
Laboratory Fortified Blank	1/run	1.0 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy and method performance
Continuing Calibration Verification (mid-point calibration standard)	1 every 10 samples	2.0 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy and method performance

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Table 22: NHDES Laboratory Analysis QC Sample Table for Dissolved Orthophosphate (PO₄-P)

(based on EPA-NE QAPP worksheet #24a)

Analytical Method/SOP Reference : Appendix C-6		Measurement Performance Criteria : <u>EPA 365.2 by Lachat 10-115-01-1-B</u>		Number of Samples : _____	
Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptable Limits	Corrective Action (CA)	Person(s) Responsible For CA	Data Quality Indicator (DQI)
Method Blank	1 at beginning, end and every 10 samples	<RL	Invalidate the run and repeat	Analyst, Inorganic Supervisor, Quality Control Supervisor	Contamination, drift, method performance
Reagent Blank	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA
Laboratory Duplicates	1 every 10 samples	0 – 0.002 mg/L	Repeat, qualify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Precision
Laboratory Matrix Spike	1 every 10 samples	80 – 120%	Repeat, qualify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Matrix effect
Laboratory Control Sample	1/run	0.150 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy
Laboratory Fortified Blank	1/run	0.100 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy and method performance
Continuing Calibration Verification (mid-point calibration standard)	1 every 10 samples	0.500 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Drift

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Table 23: NHDES Laboratory Analysis QC Sample Table for Total Phosphorous – as P

(based on EPA-NE QAPP worksheet #24a)

Analytical Method/SOP Reference : Appendix C-7		Measurement Performance Criteria : <u>EPA 365.2 by Lachat 10-115-01-1-F</u>		Number of Samples : _____	
Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptable Limits	Corrective Action (CA)	Person(s) Responsible For CA	Data Quality Indicator (DQI)
Method Blank	1 at beginning, end and every 10 samples	<RL	Invalidate the run and repeat	Analyst, Inorganic Supervisor, Quality Control Supervisor	Contamination , drift, method performance
Reagent Blank	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA
Laboratory Duplicates	1 every 10 samples	Range: 0 – 0.007 mg/L	Repeat, qualify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Precision
Laboratory Matrix Spike	1 every 10 samples	77-119%	Repeat, qualify run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Matrix effect
Laboratory Control Sample	1/run	0.100 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy
Laboratory Fortified Blank	1/run	0.05 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy, method performance
Continuing Calibration Verification (mid-point calibration standard)	1 every 10 samples	0.200 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Drift

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Table 24: NHDES Laboratory Analysis QC Sample Table for Total Suspended Solids (TSS)

(based on EPA-NE QAPP worksheet #24a)

Analytical Method/SOP Reference : Appendix C-8		Measurement Performance Criteria : <u>Standard Methods 2540 D</u>		Number of Samples : _____	
Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptable Limits	Corrective Action (CA)	Person(s) Responsible For CA	Data Quality Indicator (DQI)
Method Blank	NA	NA	NA	NA	NA
Reagent Blank	1 every 10 samples	0 +/- 5 mg/l	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Method performance
Instrument Blank	NA	NA	NA	NA	NA
Laboratory Duplicates	1/run	0 – 7.9 RPD	Qualify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Precision
Laboratory Matrix Spike	NA	NA	NA	NA	NA
LCS	1/run	Recovery: 82 – 105%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy
LFB	NA	NA	NA	NA	NA

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Table 25: NHDES Laboratory Analysis QC Sample Table for Total Organic Carbon (TOC)

(based on EPA-NE QAPP worksheet #24a)

Analytical Method/SOP Reference : Appendix C-9		Measurement Performance Criteria : <u>Standard Methods 5310 B</u>		Number of Samples : _____	
Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptable Limits	Corrective Action (CA)	Person(s) Responsible For CA	Data Quality Indicator (DQI)
Method Blank	NA	NA	NA	NA	NA
Reagent Blank	Beginning, End, every 10 samples	<RL	Re-run the run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Method Performance, drift, contam.
Instrument Blank	NA	NA	NA	NA	NA
Laboratory Duplicates	1 every 10 samples	Range: 0-1.17 mg/l	Re-run, qualify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Precision
Laboratory Matrix Spike	1 every 10 samples	65% - 120%	Re-un, qualify data	Analyst, Inorganic Supervisor, Quality Control Supervisor	Matrix effect
Laboratory Control Sample	1/run	14.1 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Accuracy
Laboratory Fortified Blank	1/run	10 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Method Performance
Continuing Calibration Verification: Mid-point calibration standard	1 every 10 samples	10 +/- 10%	Repeat run	Analyst, Inorganic Supervisor, Quality Control Supervisor	Drift

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Table 26: NHDES Laboratory Analysis QC Sample Table for Cholorophyll a (clor a)

(based on EPA-NE QAPP worksheet #24a)

Analytical Method/SOP Reference : Appendix C-11		Measurement Performance Criteria : <u>No Reference in Standard Methods</u>		Number of Samples : _____	
Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptable Limits	Corrective Action (CA)	Person(s) Responsible For CA	Data Quality Indicator (DQI)
Method Blank	NA	NA	NA	NA	NA
Reagent Blank	NA	NA	NA	NA	NA
Instrument Blank	1/run	NA (used for background correction)	NA	NA	Accuracy/ Bias
Laboratory Duplicates	10%	0.0– 5.0 +/- 1.0 >5.0 – 10 +/- 1.70 >10.0 – 30.0 +/- 2.84	Invalidate / Exclude data*	TMDL Coordinator	Precision
Laboratory Matrix Spike	NA	NA	NA	NA	NA
Laboratory Control Sample	NA	NA	NA	NA	NA
Laboratory Fortified Blank	NA	NA	NA	NA	NA

* Note : All the sample is used when running this analysis, therefore, if laboratory duplicates do not meet an acceptance limit there is no recourse, invalidate/exclude the data.

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14.0 Data Acquisition Requirements

Secondary data will be used in this TMDL for modeling purposes. The source of the secondary data is the New Hampshire Department of Environmental Services (NHDES). In 2001, NHDES collected three rounds of water quality data according to the NHDES 2001 Ashuelot River QAPP written by Greg Comstock dated July 20, 2001. The data quality/performance measurement criteria for the secondary data is consistent with the 2002 study. Any secondary data that falls outside this criteria will be flagged as questionable data.

Table 27, summarizes Non-direct Measurements Criteria and Limitations. As shown, non-direct data will be used primarily for comparison / screening purposes. It is not intended to use non-direct data for input to the model. Should a comparison of non-direct data and data collected from this study, show significant differences, the data will be examined more thoroughly to determine the reason. If none can be found, additional sampling may be conducted.

Table 27. Non-Direct Measurements Criteria and Limitations Table (based on EPA Worksheet #25)

Non-direct measurement (secondary data)	Data source, report date, data generator, data collection dates	How data will be used	Limitations on data use
DES Rivers Ambient Monitoring Data	NHDES Rivers Ambient Monitoring Program	For comparison purposes	Primarily summer data
VRAP data	NHDES VRAP program	For comparison purposes and for helping to determine sources of pollutants	Primarily summer data
Historical data collected by the City of Keene	City of Keene	For comparison purposes and for helping to determine sources of pollutants	Primarily summer data
Historical data in 1989 WLA for the Ashuelot River	NHDES	For comparison purposes	Summer data
Topographic Maps	USGS	Site maps, watershed boundary, topography	Date of data collection and map generation

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15.0 Documentation, Records and Data Management

This section of the QAPP describes how project data and information will be documented, tracked, and managed from the field to final use and storage in a manner that ensures data integrity and defensibility.

15.1 Project Documentation and Records

Table 28 includes information on project documentation and records. Copies of various worksheets may be found in Appendix D.

Table 28. Project Documentation and Records Table (based on EPA Worksheet #26)

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Data Assessment Records
Field data sheets	Field worksheets	Bench book records	QA/QC chapter in final report
		Computer databases	
		Billing receipts for sample analyses	

15.2 Field Analysis Data Package Deliverables

Field analytical measurements will be generated, at the same time samples will be collected for laboratory analysis. Measurements will be recorded in on field sheets, and these data will be transferred to an electronic spreadsheet. Entries into the spreadsheet will be compared against the field sheets by a second person as a quality check.

15.3 Fixed Laboratory Data Package Deliverables

NHDES Laboratory Services Unit will provide a copy of the NHDES Laboratory Services Log-In Sheet (see Appendix D) and a computer generated form which includes the laboratory results, the sample number, matrix, collection date and time, log in date and time, analysis completion date, locator (i.e., the sampling station), description (i.e., description of the sampling station), the site (i.e., the town or city), who collected the sample, the account number and the project number. In addition, the NHDES Laboratory Services Unit, with assistance from the NHDES Watershed Management Bureau, will provide a spreadsheet of all raw data to the NHDES Watershed Management Bureau.

15.4 Data Reporting Formats

Field recordings will be made in ink. Field and laboratory data will ultimately be recorded in an electronic database (Lotus Approach) that is being designed to be with EPA's STORET data system.

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15.5 Data Handling and Management

Data Recording. Results from field measurements are written onto field worksheets (see Appendix D). Results from laboratory analyses are written onto equipment-specific bench books.

Data Transformations/Data Reduction. Data will be analyzed statistically in spreadsheet programs (Microsoft Excel) for ranges, means, medians, standard deviations, and minimum and maximum values for each sampling station.

Data Transfer/Transmittal. Data from the NHDES Lab books is entered into a database designed to generate lab analysis reports by NHDES lab personnel. Data from field and lab analysis reports will be manually input into a Lotus 1,2,3 database by NHDES Watershed Management Bureau personnel. Data entry will be checked twice. It is the intent of NHDES to ultimately upload this information into EPA's STORET database system. DES is currently working with a contractor to provide this capability.

Data Analysis.

Software. The following software will be used in data analysis: Microsoft Excel, Lotus Approach. Data will likely be analyzed using simple summary statistics in Microsoft Excel.

Analytical Models. The QUAL2E model will be used to determine the total maximum daily load of pollutants that impact dissolved oxygen.

Data Assessment. See "Data Transfer/Transmittal" section above.

15.6 Data Tracking and Control

Data Tracking

This project is small enough that specific procedures have not been established for tracking data as they are collected, transmitted, and analyzed. All data will be in the custody of the project manager, who will make sure that all hard copies and electronic copies are stored in an organized fashion.

Data Storage, Archival, and Retrieval

Hardcopies of information used to develop the TMDL report will be stored by the project manager for at least 5 years.

Electronic Copies of the following items will be stored on the computer of the project manager: Raw Data, Statistical Results, Final Report. As previously mentioned, it is the intent of NHDES to upload the field and laboratory data collected from this study into EPA's STORET database system..

All data will be stored indefinitely by NHDES. Archived information will be packaged by the project manager.

Data Security

All data are public information and need not be secured.

16.0 Assessments and Response Actions

This section of the QAPP identifies the number, frequency, and type of planned assessment activities that will be performed for the project.

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16.1 Planned Assessments

In order to determine that field sampling, field analysis and laboratory activities are occurring as planned, field staff and laboratory personnel shall meet, after the first sampling event, to discuss the methods being employed and to review the quality assurance samples. At this time all concerns regarding the sampling protocols and analysis techniques shall be addressed and any changes deemed necessary shall be made to ensure consistency and quality of subsequent sampling. Assessment frequencies and responsible personnel are shown in Table 29.

Table 29. Project Assessment Table (based on EPA Worksheet #27b)

Assessment Type	Frequency	Person(s) responsible for performing assessment, title and organizational affiliation	Person(s) responsible for responding to assessment findings, title and organizational affiliation	Person (s) responsible for identifying and implementing corrective actions (CA), title and organizational affiliation	Person (s) responsible for monitoring effectiveness of CA, title and organizational affiliation
Field Sampling	Once at beginning of study	Project Manager NHDES	Project Manager NHDES	Field Coordinator NHDES	Project Manager NHDES
Field Analytical	Once at beginning of study	Project Manager NHDES	Project Manager NHDES	Field Coordinator NHDES	Project Manager NHDES
NHDES Laboratory Services Fixed Lab	Weekly	Lab QA/QC Officer NHDES	Lab QA/QC Officer NHDES	Lab QA/QC Officer NHDES	Lab QA/QC Officer NHDES
Limnology Center Fixed Lab	Bi-Weekly	Limnology Center QA/QC Officer NHDES	Limnology Center QA/QC Officer NHDES	Limnology Center QA/QC Officer NHDES	Limnology Center QA/QC Officer NHDES

16.2 Assessment Findings and Corrective Action Responses

Field Sampling: QAPP deviations and project deficiencies determined during the field sampling assessment will be evaluated for source of deviation and corrected with verbal communications in the field and documented in field log books. Any necessary written/structural changes will be made through a revision of the SOP for that activity. Field sampling activities will be monitored to determine compliance.

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Field Analytical: QAPP deviations and project deficiencies determined during the field analytical assessment will be evaluated for source of deviation and corrected with verbal communications in the field and documented in field log books. Any necessary written/structural changes will be made through a revision of the SOP for that activity. Field analytical activities will be monitored to determine compliance.

NHDES Laboratory Services Fixed Laboratory: QAPP deviations and project deficiencies determined during the NHDES Laboratory Services fixed laboratory assessments will be addressed immediately. Replicates and critical range tables will be checked with data to determine if sources of error exist. Any deviations in results will be addressed in both written and verbal formats, and future sampling will be monitored to verify that compliance is reached.

Limnology Center Fixed Laboratory: QAPP deviations and project deficiencies determined during the limnology center fixed laboratory assessments will be addressed immediately. Replicates and critical range tables will be checked with data to determine if sources of error exist. Any deviations in results will be addressed in both written and verbal formats, and future sampling will be monitored to verify that compliance is reached.

16.3 Additional QAPP Non-Conformances

Corrective actions will be implemented any time that deviations or errors are noted in field and laboratory work during the project.

17.0 QA Management Reports

No QA Management Reports will be generated for the project. In lieu of frequent QA Management Reports, a QA/QC section will be included in the final project report, and will include the following items:

- Summary of project QA/QC programs and trainings conducted during the project
- Conformance of project activities to QAPP requirements/procedures
- Status of project and schedule delays
- Deviations from the approved QAPP and approved amendments to the QAPP
- Description and findings of assessments
- Results of data validations activities in terms of amount of usable data generated
- Required corrective actions and effectiveness of corrective action implementation
- Data quality assessments in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity (Refer to Section 20.0)
- Limitations on the use of measurement data generation

Though frequent QA management reports will not be generated, frequent reviews of data (as described in Section 16) will be conducted to determine sampling efficiency.

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18.0 Verification and Validation Requirements

The Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses will not be used for this project. Data validation will occur through the detailed examination of raw data to check for calculation, measurement within calibration range, compound identification and transcription errors. Data of known and documented quality will be provided by this examination. In addition, the results of QC checks and samples and analytical procedures as discussed in Sections 7 and 13 will be assessed. These data examinations are similar to those used in Tier II and Tier III, however the exact protocols The Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses will not be used.

19.0 Verification and Validation Procedures

This section of the QAPP describes the process that will be followed to verify and validate project data. Verification. Information regarding data verification is provided in Table 22.

Table 30. Data Verification Process (based on EPA Worksheet #29a)

Verification task	Description	Person responsible for verification (name, organization)
Field notes	Field notes will be collected at the end of each day and reviewed internally for completeness, accuracy, and comparability between sample locations and field samplers. Any required corrective actions will be addressed with field samplers prior to further site work. Copies of field notes will be maintained in the site file.	Project Manager
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness prior to submittal.	Lab QA Officers

Validation: Information regarding data validation is provided in Table 31.

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Table 31: Data Validation Summary Table (based on EPA Worksheet # 29b)

Analytical Parameter (Medium /Matrix)	Validation Criteria	Validation Criteria Modified	Data Validation Tier Level	Modified Tier Level Used	Data Validation	Responsibility for Data Validation
Laboratory						
BOD (5 day and 20 day) (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Lab QA Officer	NHDES Lab QA Officer
TKN (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Lab QA Officer	NHDES Lab QA Officer
NH3-N (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Lab QA Officer	NHDES Lab QA Officer
NO2+NO3-N (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Lab QA Officer	NHDES Lab QA Officer
TP (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Lab QA Officer	NHDES Lab QA Officer
Dissolved PO4-P (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Lab QA Officer	NHDES Lab QA Officer
Chlor a (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Lab QA Officer	NHDES Lab QA Officer
TSS (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Lab QA Officer	NHDES Lab QA Officer
TOC (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Lab QA Officer	NHDES Lab QA Officer
Field						
Temperature (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Project Manager	NHDES Project Manager
Dissolved Oxygen (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Project Manager	NHDES Project Manager
pH (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Project Manager	NHDES Project Manager
Conductivity (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Project Manager	NHDES Project Manager
Flow (Water)	See Section 18.0	Y	See Section 18.0	Y	NHDES Project Manager	NHDES Project Manager

20.0 Data Usability/Reconciliation with Project Quality Objectives

Preliminary Data Review

Data will be reviewed for completeness throughout and at the end of the field study.

Precision

Results of all field and laboratory duplicates will be presented in tabular format. For each field duplicate pair, the relative percent difference (RPDs) will be calculated for each analyte whose original and duplicate values are greater than or equal to the quantitation limit. RPDs will be compared against the measurement performance criteria presented in Section 7. For each laboratory duplicate pair, the acceptance range in Tables 18 through 25 shall be used.

Accuracy/Bias

Sample Contamination

Sample contamination will be addressed through field and laboratory duplicate analyses. Field sample results will be compared with duplicates to determine differences through the use of the equation shown in Section 7.2 of the QAPP.

Analytical Accuracy/Bias

Analytical duplicates will be conducted to determine deviations within laboratory analyses. Differences between sample and duplicate (replicate pairs) will be determined through the use of the equation shown in Section 7.

Overall Accuracy/Bias

Data will be compared with critical ranges to determine accuracy/bias of the samples, and through the use of the Accuracy/Bias equation used in Section 7.

Sample Representativeness

Field sampling SOPs will be strictly adhered to. If variation in sample results occurs, repeat sampling may take place to ensure sample representativeness.

Completeness

Data will be reviewed for completeness by determining the total number of anticipated samples that were determined at the outset of the study, and comparing that number with the actual number of data collected. See Section 7.

Comparability

Data will be manually compared to measurement performance criteria. If samples are not acceptable they will not be included in the final calculations. See Section 7.

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Data Limitations and Actions

When data do not meet acceptable standards they will be flagged and omitted from final calculations. If the data set is limited, and questionable data must be used, they will be used for reference only, and will be footnoted that data are questionable.

Data will be compared to the measurement performance criteria presented in Table 9, as well as weather/flow criteria and chain of custody information. When data do not meet acceptable standards they will be flagged and omitted from final calculations. If the data set is limited, and questionable data must be used, they will be used for reference only, and will be footnoted that data are questionable. The Project Manager will ultimately be responsible for determining the acceptability of data and/or for determining if resampling is needed.